INTERIM RECORD OF DECISION SUMMARY
OPERABLE UNIT ONE: NON-SOURCE AREA GROUNDWATER

WEST SITE/ HOWS CORNER SUPERFUND SITE
PLYMOUTH , MAINE

September 2002

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DECLARATION FOR THE RECORD OF DECISION

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West Site/Hows Corner Superfund Site
Plymouth, Penobscot County, Maine
CERCLIS Identification Number: MED985466168
PRP Lead
Operable Unit One, Non-Source Area Groundwater

B. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the West Site/Hows Corner Superfund Site (Site), in Plymouth, Maine, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA), 42 USC § 9601 et seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 et seq., as amended. The Director of the Office of Site Remediation and Restoration (OSRR) has been delegated the authority to approve this Record of Decision.

This decision was based on the Administrative Record, which has been developed in accordance with Section 113 (k) of CERCLA, and which is available for review at the Plymouth Town Hall in Plymouth, Maine and at the United States Environmental Protection Agency (EPA) Region 1 Office of Site Remediation and Restoration (OSRR) Records Center in Boston, Massachusetts. The Administrative Record Index (Appendix G of this Record of Decision (ROD)) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

The State of Maine concurs with the Selected Remedy.

C. ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

D. DESCRIPTION OF THE SELECTED REMEDY

This ROD sets forth the selected remedy for Operable Unit I at the West Site/Hows Corner Superfund Site (the Site). Operable Unit I (OU1) will target groundwater underlying the Site where volatile organic compounds (VOCs) are detected at concentrations below 10 parts per million (ppm). Groundwater with VOC concentrations below 10 ppm is generally located outside of the 2-acre fenced area of the Site (the Source Area) and includes all groundwater where the contamination has come to be located (Non-Source Area Groundwater). The cleanup action described in this ROD will require groundwater with VOCs greater than or equal to 10 ppm (Source Area Groundwater) be contained within the Source Area; Monitored Natural Attenuation (MNA) of Non-Source Area Groundwater; and environmental monitoring with a contingency that would require safe drinking water be provided to residents whose private water supply poses an unacceptable risk. Institutional controls will also be used to prevent the use of both Source Area and Non-Source Area Groundwater until the cleanup standards have been met. This cleanup approach will also prevent the further migration of Source Area Groundwater and potentially restore Non-Source Area Groundwater to safe drinking water standards. The selected remedy is a comprehensive approach that addresses all current and potential future risks posed by Non-Source Area Groundwater (Operable Unit I). As a result of the previous removal actions, contaminated groundwater is the only medium requiring remedial action.

The major components of this remedy are:

- Installation of a groundwater extraction and treatment system to contain Source Area Groundwater within the 2-acre fenced area of the Site;

- Monitoring of surface water, sediments, and Non-Source Area Groundwater to measure the progress of natural attenuation toward meeting the cleanup goals;

- Residential well monitoring with a public water contingency;

- Institutional Controls to prevent use of both Source and Non-Source Area Groundwater; and

- Five-year Reviews.

For a number of reasons, this is an interim operable unit ROD. First, due to the possible presence of dense, non-aqueous phase liquids (DNAPLs) being located within groundwater underlying the 2-acre fenced area of the Site (the Source Area), the ability to restore this part of the groundwater plume is uncertain at this time. Second, because the estimated time to restore Non-Source Area Groundwater ranges from a low of 35 years to over 1000 years, the ability to restore Non-Source Area Groundwater within a timeframe that would comply with all state and federal applicable or relevant and appropriate requirements (ARARs) is also uncertain. Consequently, a further evaluation of the technical practicability of restoring Source Area Groundwater and a more precise estimate of the time for the restoration of Non-Source Area Groundwater would be necessary before EPA could propose a final remedy for the entire Site. Because this is beyond the scope of information that is currently available, the response action for Source Area Groundwater, or Operable Unit II, and a final determination as to whether or not Non-Source Area Groundwater can be restored in an acceptable (i.e., ARAR compliant) period of time will be addressed in a subsequent ROD that will present a final remedy for the Site.

The selected response action addresses principal and low-level threat wastes at the Site by:

- Containing highly contaminated groundwater within the 2-acre fenced area of the Site, thereby allowing the potential restoration of Non-Source Area Groundwater via natural attenuation processes;

- Imposing groundwater use restrictions to prevent exposure to contaminated groundwater and further migration of contaminants; and

- Environmental monitoring with a contingency that would require public water to be provided in the event that sampling of residential wells shows unacceptable risk from contamination.

E. STATUTORY DETERMINATIONS

The selected interim remedy for Operable Unit I is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action (unless justified by a waiver), is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

The remedy also satisfies the statutory preference for treatment as a principal element as the hydraulic containment system provides some reduction in toxicity, mobility, and volume of contaminants through the extraction and treatment of contaminated groundwater.

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure (groundwater and/or land use restrictions are necessary), a review will be conducted every five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

F. SPECIAL FINDINGS

Issuance of this ROD embodies specific determinations made by the Regional Administrator or his designee pursuant to CERCLA. Although EPA expects that the remedial action described in this ROD will comply with all applicable or relevant and appropriate requirements (ARARs), current estimates of the time needed to restore Non-Source Area Groundwater to the appropriate ARARs are uncertain, and therefore, do not provide sufficient basis for EPA to make a statutory finding of compliance for the chemical-specific ARARs presented in this ROD. However, because this ROD does not constitute a final cleanup for the Site, EPA is waiving these chemical-specific ARARs for the interim pursuant to section 121(d)(4)(A) of CERCLA. This will allow EPA to gather additional information during the implementation of this ROD so that a more precise cleanup estimate and a final determination of ARAR compliance can be developed before EPA selects a final remedy for the Site.

G. ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

1. Chemicals of concern (COCs) and their respective concentrations.

2. Baseline risk represented by the COCs.

3. Cleanup levels established for COCs and the basis for the levels.

4. How source materials constituting principal threats are addressed.

5. Current and reasonably anticipated future land assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD.

6. Potential land and groundwater use that will be available at the Site as a result of the selected remedy.

7. Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected.

8. Key factor(s) that led to selecting the remedy.

H. AUTHORIZING SIGNATURES

This ROD documents the selected remedy for the West Site/ Hows Corner Superfund Site. This remedy was selected by USEPA with concurrence of the Maine Department of Environmental Protection (MEDEP).

U.S. Environmental Protection Agency

By: ______________________
Richard A. Cavagnero, Acting Director
Office of Site Remediation and Restoration
Region 1

Date: Sept 24, 2002

PART 2: THE DECISION SUMMARY

A. SITE NAME, LOCATION, AND BRIEF DESCRIPTION

West Site/ Hows Corner Superfund Site
Plymouth, Penobscot County, Maine
CERCLIS Identification Number: MED985466168
PRP Lead
Operable Unit One, Non-Source Area Groundwater

The West Site/ Hows Corner Superfund Site (the Site) is located on Saywer Road, Penobscot County, Plymouth, Maine (see Figure 1). The Site is defined as a 17-acre parcel of land owned by George West and the groundwater beneath the surrounding properties where contamination has come to be located. Mr. West used a small, 2-acre portion of the Site to operate a waste oil facility from 1965 to 1980. This 2-acre portion of the Site is referred to as the “Source Area” to distinguish it from the term “Site” which, as previously mentioned, also includes the groundwater beneath the surrounding properties where contamination has come to be located. The area surrounding the Source Area is rural residential with mixed woods and open fields. In 1995, the United States Environmental Protection Agency (EPA) placed the Site on the National Priorities List (NPL) due to the discovery of contaminated soil within the Source Area and contaminated groundwater underlying the Source Area and surrounding properties.

A more complete description of the Site can be found in Section 1 of the RI Report (Woodard & Curran, July 2001).

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

From 1965 to 1980, Mr. West operated a waste oil storage and transfer facility within 2-acre portion of his 17-acre parcel of land. Waste oils were stored in eight above ground storage tanks (ASTs) ranging in volume from 1,000 to 20,000 gallons. According to documents obtained from Mr. West and other sources, in excess of 235,000 gallons of waste oil and other liquids were received at the facility for storage and transfer during operations. After separating the waste oils based on density, lighter oils were sold to greenhouses, paper companies, and others as fuels, and heavier oils were spread on dirt roads for dust control. Operations ceased in 1980, and the tanks were disassembled and sold as scrap.

A more detailed description of the Site History can be found in Section 1.3 of the RI Report.

2. History of Federal and State Investigations and Removal and Remedial Actions

Environmental investigations were initiated in 1988 by the Maine Department of Environmental Protection (MEDEP) after contaminated groundwater was discovered in a residential well that was sampled during a pre-purchase environmental assessment of Mr. West's property in 1987. MEDEP sampled other wells in the immediate area and found 10 residential wells contaminated with chemicals often used as industrial solvents or degreasers (e.g., tetrachlorethene "PCE", trichloroethylene "TCE"). As an emergency response measure, MEDEP provided bottled water and installed dual in-line granular carbon filters to all homes found to have contaminated water. MEDEP completed a Preliminary Assessment of the Site in June 1989, and subsequently completed a preliminary groundwater investigation in March 1990. Based on the results of the preliminary investigations, and the desire to provide a permanent, safe water supply for nearby residents, MEDEP requested the assistance of EPA in July 1990 after determining that the costs to implement the necessary removal actions were beyond the resources available to MEDEP. Consequently, EPA completed a Removal Action in 1990-91 which included the installation of a fence around the 2-acre Source Area and the excavation and off-site disposal of approximately 847 tons of contaminated soil within this area. In March 1994, EPA/MEDEP completed construction of the public water supply system which provided safe water to 33 residences surrounding the Source Area, with the potential to provide water to several additional residences. The Site was placed on the National Priorities List (NPL) in September 1995.

In October 1999, the West Site/ Hows Corner Superfund Site Group of Potentially Responsible Parties (PRP Group) voluntarily agreed to perform a Remedial Investigation/ Feasibility Study (RI/FS) at this Site. This agreement was subsequently formalized in an Administrative Order (RI/FS AOC) with EPA that was finalized in May 2000. The Remedial Investigation was initiated in October 1999 and included: groundwater, surface water, sediment, surface soil, and air sampling; installation of bedrock monitoring wells; residential well sampling; packer testing of bedrock wells; geophysical surveys and bedrock mapping; and computer modeling of groundwater and contaminant movement through the bedrock aquifer. Additional fieldwork was conducted in the Spring of 2000 to supplement the Fall 1999 sampling program. Data from the RI was then used to complete a Baseline Human Health and Ecological Risk Assessment Report. A final RI, including the baseline risk assessments was presented to EPA in July 2001.

A summary of the CERCLA investigations at the Site is included in Table 1.

3. History of CERCLA Enforcement Activities

The CERCLA enforcement activities at the Site are summarized below:

- In May 1998, EPA issued 104(e)/General Notice letters to approximately 400 potentially responsible parties (PRPs) who either generated or transported waste to the Site.

- In May 1998, an Administrative Order by Consent (Removal AOC) for continued monitoring of residential wells was signed by approximately fifteen PRPs. The purpose of this Removal AOC was to ensure that nearby residences would be provided with safe drinking water in the event that sampling results from their existing residential well showed site related contaminants in excess of state and federal drinking water standards.

- In October 1999, the PRP Group, representing over 100 PRPs, volunteered to conduct an RI/FS on its own. The terms of this undertaking were outlined in the RI/FS AOC that was executed in May 2000.

- In September 2000, EPA sent a settlement proposal in the form of a Consent Decree (CD) to each of the PRPs. This proposal settlement resolved each PRPs financial liability for past costs incurred at the Site. Over 130 parties signed the CD which resulted in EPA recovering over $2.5 million in past response costs. This CD was entered in U.S. District Court on December 4, 2001. After this CD was finalized, EPA sent a proposal settlement to approximately 80 additional parties that was based their documented financial “ability to pay.” This settlement is was entered by the Court on April 11, 2002.

C. COMMUNITY PARTICIPATION

Prior to the installation of the public water supply, community concern and involvement was high. It has since become moderate. EPA and MEDEP have kept the community and other interested parties apprized of Site activities through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of the recent public outreach efforts.

- On October 14, 1998, EPA and MEDEP, held an informational public meeting in Plymouth, Maine to describe field activities planned at the Site.

- In October 1998, EPA released a Community Relations Plan that outlined a program to address community concerns and keep citizens informed about and involved in remedial activities.

- In November 1999, EPA released a fact sheet to provide the community with an update on the status of the Remedial Investigation/ Feasibility Study. This was followed by fact sheets in March and August 2000.

- On April 16, 2002, EPA held an informational meeting to discuss the results of the cleanup alternatives being evaluated.

- On July 10, 2002, EPA held a meeting to present the Agency's Proposed Plan to the community . At this meeting, representatives from EPA and MEDEP answered questions from the public. EPA also made the administrative record available for public review at EPA's offices in Boston and at the Town Hall in Plymouth, Maine.

- From July 12, 2002 to August 12, 2002**,** the Agency held a 30-day public comment period to accept public comment on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public.

- On August 6, 2002, EPA and MEDEP held a formal public hearing in Plymouth, Maine to discuss the Proposed Plan for the remedial action at the Site and accept formal public comment. A transcript of this meeting, the comments received, and the Agency's response to comments are included in the Responsiveness Summary, which is part of this ROD.

D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The selected remedy for the Site was developed by combining components of source control and management of migration to obtain a comprehensive approach for site remediation. This remedy will be the first phase of the long term groundwater cleanup action and will target Non-Source Area Groundwater which is defined as groundwater underlying the 17-acre George West property and surrounding area where volatile organic compounds (VOCs) are detected at concentrations below 10 parts per million (ppm). The selected remedy will prevent exposure to contaminated groundwater and potentially restore Non-Source Area Groundwater to drinking water standards at some point in the future. EPA will accomplish this cleanup task by constructing a groundwater extraction and treatment system to contain highly contaminated groundwater within the Source Area of the Site thereby allowing the cleanup of Non-Source Area Groundwater through natural attenuation processes. During this time, institutional controls will be imposed to prevent use of the groundwater until the contamination is reduced to acceptable levels. Residential wells that are in use prior to the implementation of institutional controls will be sampled with a contingency that would require public water be provided should sampling indicate that people are being exposed to contaminants that pose an unacceptable risk.
In summary, the response action contained in this ROD addresses the remaining threats to human health and the environment posed by Non-Source Area Groundwater. However, due to the uncertainty associated with cleanup times for Non-Source Area Groundwater, EPA cannot make a determination that all state and federal ARARs will be met in the long term. As a result, these chemical-specific ARARs will be waived in the interim until a final determination can be made in a subsequent ROD. This subsequent ROD will also address Source Area Groundwater (Operable Unit II).

E. SITE CHARACTERISTICS

The sources of contamination, release mechanisms, exposure pathways to receptors for contaminated groundwater as well as other site specific factors, are diagramed in a Conceptual Site Model (CSM). The CSM is a three-dimensional "picture" of migration routes and potential receptors. It documents current and future site conditions and shows what is known about human and environmental exposure through contaminant release and migration to potential receptors. The risk assessment and response action for Non-Source Area Groundwater (OU1) are based on this CSM.

The CSM for the Site is based on the Final RI Report (Woodard & Curran, July 2001). This report concluded groundwater underneath the George West property and surrounding area is contaminated by chlorinated solvents (predominantly PCE), and to a lesser extent, polychlorinated biphenyls (PCBs). In addition, because concentrations of PCE within the Source Area have historically remained high, it is likely that a remnant PCE source remains within the fractures of the rock beneath the Source Area. Consequently, PCE is continuing to be dissolved in the Source Area forming a groundwater plume that migrates underneath the George West property and a number of additional properties.

Section 1 of the FS Report (Woodard & Curran, July 2002) contains an overview of the supplemental soil sampling that was performed as a result of a groundwater pilot study that required the excavation of soil within the Source Area to allow access to the bedrock fractures. Because this soil excavation occurred in areas where EPA previously removed contaminated soil as part of the 1990-91 Removal

Action, the soil was tested and subsequently disposed of off-site as an Investigative Derived Waste (IDW) as it contained concentrations of lead and PCBs that were above levels considered to be protective. As a result of the 1990-91 Removal Action and the subsequent disposal of IDW, soils remaining within the source area no longer contribute to the degradation of water quality or pose an unacceptable risk. Consequently, the CSM only focuses on groundwater as all other sources of contamination have been addressed through previous activities. The significant findings of the RI and the supplemental soil sampling are summarized below.

1. Site Setting, Geology and Hydrogeology

The West Site/ Hows Corner Superfund Site lies in a rural section of east- central Maine in the Town of Plymouth. The Site includes the 17-acre George West property and all areas where groundwater contamination has come to be located (see Figure 2). All but two acres of the George West property (the Source Area) have been recently revegetated after being clear-cut approximately 10 years ago. The Source Area sits near the top of a hill, and bedrock is exposed in the surface in many areas. The surface elevation surrounding the Source Area decreases in all directions, with a steeper drop to the north and west. A small, unnamed pond and associated wetlands abut the eastern side of the Source Area. Plymouth Pond is located approximately one-half mile to the north of the Site, and Martins Stream, which drains into Plymouth Pond is located to the south. The closest residence is located approximately 100 feet to the south.

The surficial materials in the vicinity of the Site are comprised of various sands and compacted sand, silt, and gravel deposits placed during the advancement and retreat of glacial ice sheets. Glacial till is the most extensive surficial deposit within the Site, and is the only deposit underlying the George West property. This till lies in direct contact with the bedrock and is laterally extensive and discontinuous at higher elevations. The till is comprised of a heterogeneous mixture of sands, silts, clays and gravels and varies in density from dense to loose. Within the Source Area, these unconsolidated soils can range from 0 to 5 feet. Deposits outside of the source area are generally thicker, but for the most part, unsaturated at the higher elevations in the area. Bedrock within the Source Area is exposed because of previous removal actions undertaken at the Site. Other bedrock outcrops are visible outside the Source Area.

The bedrock geology beneath the Site consists of alternating layers of metasedimentary rock of phyllite grade with the majority of fractures occurring in the top 80 ft. Three sets of bedrock fractures have been mapped at the Site with the primary set of fractures having a strike running northeast to southwest, and a near vertical dip. Observations made during drilling indicate that the bedrock becomes more competent with depth and to the west of the Site. Groundwater flow within the Site is entirely in bedrock and discharges upward to the overburden as it moves away from the Source Area along the flanks and bottom of the hill.

A total of 24 monitoring wells were installed as part of the RI. Observations of drilling rates, return water characteristics, and air loses encountered while drilling were used as a basis for identifying fractures within the bedrock. Based on the number of fractures and drilling characteristics observed, the frequency of fracturing within the source area and surrounding properties was interpreted to decrease considerably at depths greater than 80 feet below ground surface (bgs). In addition, packer permeability testing of 15 of the boreholes completed as wells showed that hydraulic conductivity of bedrock intervals containing fractures is an order of magnitude higher than in intervals without fractures. Because many of the boreholes were completed as well couplets, the water level of the shallow borehole was monitored during the packer testing of the deeper borehole. In general, the water level of these shallow wells did not respond when water was injected into the deeper borehole indicating that the fractures are poorly connected between the deep and shallow portions of the paired boreholes. Collectively, this information led to the conclusion that the deeper zones of the bedrock do not transmit water as readily as the shallower bedrock zones.

Based on the geologic conditions at the Site, groundwater flows within a single, unconfined flow system in two distinct geologic media, the unconsolidated overburden and the bedrock. However, because the overburden underlying the George West property is unsaturated and relatively thin or, as in the Source Area, absent entirely, groundwater flow in the vicinity of the Source Area is entirely within the bedrock. Bedrock flow discharges to the overburden along the flanks of the hill, and in several locations springs are found where very steep cuts and topographic changes in the bedrock surface intersect the bedrock groundwater table. As overburden thickens and the groundwater elevations drop, groundwater discharging from the bedrock begins to saturate the overburden along the flanks of the hill, forming small surface water bodies in areas where topographic depressions intersect the overburden groundwater table. These depressions form groundwater withdrawal points by allowing water to leave the flow system through increased evapotranspiration, and in some cases, overland flow through intermittent streams.

Groundwater flow in the bedrock is controlled by the nature, frequency, and distribution of fractures occurring within the bedrock. Data collected during the RI indicates that groundwater flow is radial away from the Source Area. Horizontal groundwater flow is restricted to the west of the Source Area due to the presence of a fault and is affected by the withdrawal of groundwater by irrigation or stock wells, shallow surface water bodies, and springs located near the source area. The irrigation wells are currently not being used for human consumption. Because the bedrock flow system has very low storage, small withdrawals from any one of these sources can have a significant localized effect on the flow of bedrock groundwater.

The vertical flow of groundwater is directly related to the interconnectivity of fractures with depth, the continuity of steeply dipping bedding fractures, the horizontal gradients, and the ability of the upper and lower portions of the bedrock flow system to drain. On the flanks of the hill where highest horizontal gradients exist, significant vertical gradients exist between the shallow and deep portions of the bedrock flow system at some locations. Here the horizontal gradients and the reduced interconnection between the shallow and deep flow systems may allow the two flow systems to act more independently. With a decreased fracture concentration with depth (hence lower storage) and a strong horizontal gradient, the groundwater in the lower bedrock can drain more readily. This, coupled with the reduced interconnection between the upper and lower portions of the bedrock flow system, can create the strong vertical downward gradients from the upper portion of the bedrock flow system to the deeper portion of the bedrock flow system as evidenced by the monitoring wells located northeast of the Source Area. At other locations, however the vertical gradients are weaker. Collectively, these observations led to the conclusion that groundwater flows radially away from the Source Area, however, geologic conditions restrict groundwater flow to the west of the Source Area and within deeper bedrock zones (i.e., greater than 80 ft. bgs). As groundwater flows away from the Source Area it discharges to the overburden along the flanks and bottom of the hill forming small surface water bodies in areas where topographic depressions intersect the overburden groundwater table.

2. Nature and Distribution of Contamination

This section describes the nature and distribution of contaminants in groundwater, surface water, soil, air, and sediments at the Site, as determined by sampling events conducted during the RI. Comprehensive groundwater, surface water, soil and sediment sampling data collected through September 2001 are included in this ROD as Tables 2, 3, 4, and 5 respectively. Soil sampling locations are indicated in Figure 3, surface water and sediment locations are indicated on Figure 4, and groundwater sampling locations are indicated in Figure 5.

Soil:

Surface and shallow soil samples were collected from 42 locations during the RI. Samples were collected from within the 2-acre Source Area and at locations more than 100 feet away from the Source Area. An additional five locations within the Source Area were sampled during the in-situ chemical oxidation pilot study conducted in September 2001 as this activity resulted in the excavation and off-site disposal of soils that were represented by 14 of the 42 locations previously sampled. Two soil samples were also collected from a seep that was identified during the RI as this area is potentially influenced by groundwater underlying the Source Area. No other properties were sampled because a review of historical areal photographs and site reconnaissance indicated that soils on the properties surrounding the George West property would not have been affected by waste oil operations that occurred within the Source Area. Soil samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and inorganics (metals). Based on the analytical results, soils remaining within the Source Area did not contain significant levels of contaminants when compared to soil screening values (i.e., EPA Region 9 Preliminary Remediation Goals) or background concentrations located outside of the Source Area. Details regarding the soils investigation can be found in Section 4.1 of the RI Report.

Surface Water and Sediments:

Surface water and sediment samples were collected from 12 discreet surface water bodies during the RI. Surface water bodies as far away as 4800 feet to the north (Plymouth Pond), 1600 feet southeast, and southwest of the Source Area were included in the sampling program because groundwater flows away from the Source Area and discharges to many surface water bodies surrounding this part of the Site. With the exception of a groundwater seep located in a ravine approximately 500 feet north of the Source Area, and a small temporary spring-fed pond located 500 feet west of the Source Area, sediment samples were co-located with each of the surface water samples. Samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and inorganics. Based on the analytical results, SVOCs, PCBs, and pesticides were not detected in any of the surface water bodies. Inorganics, which occur naturally in surface waters, were compared to background locations to determine if the concentrations measured are related to the Site, or similar to other surface water bodies in the area. The results of this comparison indicate that the analytical results are consistent with background concentrations. VOCs were found at low concentrations in eleven surface water bodies surrounding the Source Area with tetrachloroethylene (perchloroethylene or PCE) being the dominant compound. Concentrations of PCE varied from a low of 2 ppb at Martins Stream and the spring-fed pond west of the Source Area, to a high of 82 parts per billion (ppb) at the sample taken from the seep north of the Source Area. Other compounds detected at low concentrations included trichloroethylene (TCE), 1,1,1-trichloroethane, and toluene.

Sediment samples were analyzed for VOCs, SVOCs, pesticides, PCBs, and inorganics. These samples were also analyzed for total organic carbon (TOC) and percent solids to ensure that the sample collected was a representative sediment sample. Similar to the surface water samples, SVOCs, PCBs, and pesticides were not detected in any of the sediment samples. Likewise, the inorganic analysis indicated that metals concentrations in sediments are consistent with background concentrations. VOCs were detected in samples collected from three different surface water bodies: the Farm Pond, the Road Pond, and the Site Pond. VOCs detected include: PCE, TCE, cis-1,2-dichloroethene, and trans-1,2-dichloroethene. Unlike the surface water sampling results, the results of sediment sampling did not show a dominant compound. In addition, the sediment sampling results showed a higher degree of variability with concentrations ranging from a low of 10 ppb (e.g. PCE in the Farm Pond) to a high of 9,800 ppb (e.g., cis-1,2-dichloroethene in the Road Pond). Details regarding the surface water/sediment investigation can be found in Section 4.2 of the RI Report.

Air:

Ambient air was sampled during the RI to assess the potential for soils potentially contaminated by VOCs to adversely impact ambient air by off-gassing from the Source Area. Air samples were located to be representative of the Source Area, and at upwind/downwind locations. Because acetone was the only VOC detected, off-gassing of VOCs into air is not an issue given that acetone was not found in soil at significant concentrations, and it is a common laboratory contaminant.

Groundwater:

Three groundwater sampling events have been performed as part of the RI/FS. Groundwater samples were collected from 24 existing MEDEP monitoring wells, 24 newly installed RI monitoring wells, and 25 residential wells. The samples were analyzed for a full range of contaminants (VOCs, SVOCs, PCBs, and inorganics (metals)). The results of this sampling are summarized below.

<u>Source Area</u>: Thirteen monitoring wells are located within the Source Area. Both historical data and the results of the three RI sampling events show this area to have the highest concentrations of VOCs with PCE being the dominant compound. Concentrations of PCE ranged from a low of 410 ppb at MW-101I to a high of 32,000 ppb at MW-104I. Other VOCs detected a high concentrations within the Source Area include: TCE, cis-1,2-dichloroethene, and 1,1,1-trichloroethane. PCBs (Arochlor 1260), pesticides (dieldren), and SVOCs (1,2,4-trichlorobenzene) were also detected in Source Area wells, but at relatively low concentrations. Similarly, the inorganic analysis did not show significant concentrations of metals in any of the Source Area wells with the exception of manganese, which was detected at significant concentrations in a few wells, but with no observable trend. The relatively few locations where PCBs, SVOCs and pesticides were detected indicate that the extent of contamination for these compounds is limited to groundwater in the vicinity of the MW-2 well cluster located in the center of the Source Area. Conversely, the presence of high concentrations of PCE and other chlorinated VOCs in all of the Source Area monitoring wells indicate that these compounds have contaminated groundwater throughout the Source Area.

<u>Non-Source Area:</u> Thirty-five monitoring wells and 25 residential wells comprise the monitoring well network for Non-Source Area locations. Similar to the Source Area results, chlorinated VOCs (e.g. PCE, TCE), were the primary family of VOCs detected in Non-Source Area Groundwater wells. Phenol and bis(2-ethylhexyl) phthalate were detected in a few monitoring wells, but were later

determined to be unrelated to the Site. No other SVOCs were found in Non-Source Area wells. PCBs, and pesticides were not detected in any Non-Source Area wells. Inorganic elements were not detected at significant concentrations when compared to background locations or federal maximum contaminant levels or state maximum exposure guidelines. However, concentrations of arsenic were elevated in one well located southeast of the Source Area (MW-111D).

Figure 6 illustrates the distribution of VOCs in the bedrock aquifer based on the data collected during the RI. Figure 7 and 8 show the isoconcentration maps for PCE in both the shallow and deep bedrock aquifer. Figure 9 shows PCE concentrations with depth. Because PCE generally accounts for 90 percent or more of the total VOC concentration in groundwater, the PCE and VOC plumes are similar. Collectively, these figures show that the VOC plume extends in all directions from the Source Area, but is elongated in the northerly and northeasterly directions. In addition, the isoconcentration gradients to the west and south of the Source Area are steeper than those observed in other directions within the shallow bedrock aquifer, and those observed in deep bedrock groundwater. Further information regarding the nature and extent of groundwater contamination can be found in Section 4.4 of the RI report.

3. Fate and Transport of Contamination

Based on work completed during the RI, a conceptual model for the occurrence of contamination in groundwater has been developed for the Site. Note that this discussion focuses on PCE as it was identified to be the primary risk driver for the Site. However, the discussion and conclusions can be applied to the other contaminants of concern as they will have fate and transport characteristics similar to PCE.

As shown in Figure 10, groundwater flows radially outward from the Source Area due to its location near the top of a hill. Interconnected bedrock fractures are virtually the only avenue for contaminant migration. Recharge falling on top of the hill percolates into the bedrock underlying the Source Area, where it comes in contact with high concentrations of PCE residing the bedrock fractures. Thereafter, groundwater dissolves the PCE and carries the contamination to downgradient locations or areas having lower groundwater elevation.

The distribution of fractures and residential pumping wells cause the contaminants to have a preferred migration pathway north and east of the Source Area. As shown in Figure 10, flow to the west is restricted by the fault zone and the more competent rock that is associated with it. Figure 11 shows the conceptual understanding of how fewer bedrock fractures below 80 feet restrict groundwater flow and PCE migration. Monitoring of water levels in adjacent wells during packer testing showed that the fractures at depth are not well connected to the shallower fractures. With fewer fractures and lower interconnectivity, and resulting lower hydraulic conductivity, groundwater flow and contaminant migration is restricted west of the Source Area, and remains in the upper portions of fractured rock. The primary forces controlling the migration of contaminants include the hydraulic head differences created by drops in elevation, and local points of groundwater discharge created by surface springs and residential well pumping. Because the storage in bedrock fractures is so low, a small amount of residential water supply pumping, or discharge to small surface water bodies where evapotranspiration removes water from the groundwater flow system, can cause significant influences on contaminant migration.

A groundwater model for the Site was constructed based on the conceptual understanding discussed above. The purpose of the modeling was to simulate the groundwater flow through the system such that a detailed water balance analysis could be completed, aid in determining the potential long-term fate and transport of the contaminant plume including plume stability. The groundwater model was calibrated to existing conditions at the Site. Once calibration of the model was achieved, a sensitivity analysis of the values applied to the model was performed to ensure that the model provided a valid approximation of groundwater flow. Based on the results of the modeling, and all data collected during the RI, the PCE groundwater plume depicted in Figure 6 represents the maximum extent of groundwater contamination originating from the Site. While it is unlikely that the groundwater plume would extend any further, changes of existing groundwater use patterns within the known extent of groundwater contamination could result in changes to the interplume PCE boundaries depicted in Figures 7 and 8. Consequently, this figure assumes that current groundwater use patterns remain constant.

<u>Uncertainty Assessment</u>

Uncertainties exist in model outputs because of uncertainties in the input parameter values and model construction. Relatively large uncertainty is thought to be associated with the recharge rate, and the calibration statistics associated with the sensitivity analysis for this parameter demonstrates this conclusion. However, this uncertainty does not effect the maximum extent of groundwater contamination depicted in the figures because all model runs provided similar plume boundaries. Sensitivity analysis on the fault to the west of the Source Area, demonstrated that without a low permeability fault, the groundwater flow would be significantly different than what was observed in the field. Despite the certainty that a low permeability fault is present, there are uncertainties regarding the length, width, and transmissivity of the fault zone. Gross hydraulic conductivities and specific yield were relatively insensitive to changes in the input values. Nevertheless, heterogeneties in the distribution of hydraulic conductivities and specific yield introduce uncertainty into the model output if evaluated on a detailed local level.

F. CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

The area surrounding the George West property is currently residential and it is assumed that the area will continue to be used as residential property in the future. The 17-acre George West property currently includes 15 acres which are undeveloped. This undeveloped property is currently inactive with no existing building structures other than the fence surrounding the 2-acre Source Area. The Source Area is cleared and the majority of this area is exposed to bedrock. Groundwater underlying this property is currently unsuitable as a drinking water source. Reasonably anticipated reuse options of the George West property would likely be limited to areas outside of the Source Area and include residential or conservation/recreational uses as these uses would be consistent with the historical use of the property and would likely be compatible with the surrounding residential properties.

G. SUMMARY OF SITE RISKS

A baseline human health and ecological risk assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The human health risk assessment (HHRA) followed a four step process: 1) hazard identification, which identified those hazardous substances which, given the specifics of the Site were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and 4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates. A summary of those aspects of the HHRA that support the need for remedial action is discussed below followed by a summary of the ERA.

1. Human Health Risk Assessment

The HHRA performed an evaluation of risk to contaminants found in surface water, sediment, soil, and groundwater. As the health risks attributed to contaminants detected in surface water, sediment, and soil were deemed acceptable whereas the risks attributed to exposure to groundwater contamination were not, only the latter risks are summarized in this ROD. Twenty-three of the 62 chemicals detected in groundwater (Source Area and Non-Source Area) were selected for evaluation in the HHRA as chemicals of potential concern (COPCs). The COPCs were selected to represent potential site-related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment and can be found on page 6-42 of the RI Report. From the selection of groundwater COPCs, a subset of the chemicals was identified in the FS as presenting a significant current or future risk and are referred to as the chemicals of concern (COCs) in this ROD. The groundwater COCs are summarized in Table 6, which includes the detection frequency, range of detections, and exposure point concentrations (maximum detected concentrations) used to evaluate the reasonable maximum exposure (RME) scenario in the baseline risk assessment for the COCs. Estimates of average or central tendency exposure concentrations for the COCs and COPCs can be found in Section 6 of the RI.

<u>Exposure Assessment</u>

Potential human health effects associated with exposure to the COPCs were estimated quantitatively or qualitatively through several hypothetical exposure pathways that were developed to reflect the potential for exposure to hazardous substances based on the present uses, potential future uses, and location of the Site. Because groundwater in the vicinity of the Source Area continues to be used as a drinking water source, the exposure point is considered to be any point within the groundwater plume. Although the public water supply installed by EPA/MEDEP in 1993-94, and the continued monitoring of existing private wells helps to ensure that people are not exposed to unsafe levels of groundwater contaminants, the possibility exists that people will be exposed to unsafe levels of groundwater contaminants at some future time. Consequently, people who rely on groundwater for their water supply source, or who may do so in the future, were considered the exposed population.

Exposure to contaminated groundwater was assumed to occur via direct ingestion, and through dermal contact, and inhalation (such as while bathing or showering). Residents were assumed to ingest 2 liters of water per day, 350 days per year, for a 30-year exposure duration (EPA, 1991). Inhalation exposures from the use of a water supply for bathing were evaluated for volatile organic compounds (VOCs) only assuming the risks were comparable to direct ingestion (EPA, 1991). A qualitative evaluation of the potential risks from exposure to VOCs migrating from groundwater to indoor air through the soil was also included. Exposure via dermal contact (e.g., while bathing) was assumed to occur 350 days per year, for a 30-year exposure duration and the entire adult body surface area (18,000 cm^2) was assumed to contact the water about 35 minutes per day (EPA, 1991, 1992). General indoor air exposures from vapor intrusion was evaluated using readily available criteria established by the Commonwealth of Massachusetts (MCP GW-2 standards) for this purpose based on the Johnson and Ettinger model. Each exposure was assumed to be to the maximum detected concentration of each COC detected.

A more thorough description of exposure pathways evaluated in the HHRA, including estimates for an average exposure scenario, can be found Section 6 of RI (Woodard & Curran, July 2001).

<u>Risk Characterization</u>

Excess lifetime cancer risks were determined for each exposure pathway by multiplying a daily intake level with the chemical specific cancer potency factor. Cancer potency factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk is unlikely to be greater than the risk predicted. The resulting risk estimates are expressed in scientific notation as a probability (e.g., 1×10^{-6} for 1/1,000,000) and indicate that an average individual is not likely to have greater that a one in a million chance of developing cancer over 70 years as a result of site-related exposure (as defined) to the compound at the stated concentration. All risks estimated represent an "excess lifetime cancer risk" - or the additional cancer risk on top of that which we all face from other causes such as cigarette smoke or exposure to ultraviolet radiation from the sun. The chance of an individual developing cancer from all other (non-site related) causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site related exposure is 10^{-4} to 10^{-6}. (MEDEP has an acceptable risk of less than 10^{-5}). Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances. A summary of the cancer toxicity data relevant to the groundwater COCs is presented in Table 7.

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily intake level by the reference dose (RfD) or other suitable benchmark. Reference doses have been developed by EPA and they represent a level to which an individual may be exposed that is not expected to result in any deleterious effect. RfDs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. A HQ ≤ 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g. liver) within or across those media to which the same individual may reasonably be exposed. A HI ≤ 1 indicates that toxic noncarcinogenic effects are unlikely. A summary of the noncarcinogenic toxicity data relevant to the groundwater COCs is presented in Table 8.

Table 9 presents the carcinogenic and non-carcinogenic risk summaries for the COCs in groundwater from monitoring wells that were evaluated to reflect present and potential future exposure from ingestion, inhalation, and dermal contact to residents corresponding to the reasonable maximum exposure (RME) scenario. The qualitative evaluation of the risks associated with contaminants potentially migrating from groundwater to indoor air suggested it could result in unacceptable risks were a structure to be constructed atop the Source Area. Projections for existing occupied residential structures did not suggest significant indoor air exposure given present groundwater concentrations. Risks posed by potential exposure to other media (e.g., soils, sediments, surface water) were deemed acceptable and thus are not summarized in this ROD. Readers are referred to Section 6 of the RI Report for a more comprehensive risk summary.

<u>Uncertainty</u>

Important sources of uncertainty in the hazard identification and exposure assessment of the HHRA included:

- Likelihood of exposure pathways;
- Locations of samples and adequacy of data;
- Selection of COCs;
- Exposure assumptions (e.g., frequency, duration, and intensity); and
- Assumptions regarding physiological factors (e.g., dermal absorption rates, inhalation rates)

Important sources of uncertainty in the toxicity assessment included:

- Carcinogenic toxicity expressed in cancer slope factor, which reflect uncertainties in the extrapolation from high to low doses and extrapolating from animals to humans;
- Noncarcinogenic toxicity as expressed in Reference Doses, which reflect uncertainties in extrapolating to sensitive human populations, from animals to humans, and from shorter-term to longer-term studies;
- Use of linearized, multistage model to derive cancer slope factors;
- Summation of effects (cancer risks and hazard indices) from multiple substances; and
- Use of uncertainty factors in the derivation of reference doses.

Conservative assumptions were made throughout the risk assessment to ensure that human health is sufficiently protected. Therefore, when all of the assumptions are combined, it is much more likely that risks are overestimated rather than underestimated. A complete discussion of the evaluation of uncertainty for the Site is available in Section 6 of the RI.

<u>Summary of Human Health Risks</u>

Human health risks from contamination present in both Source Area and Non-Source Area Groundwater are presented in Table 9. This risk assessment evaluated a potential future residential groundwater exposure scenario for Source Area and Non-Source Area Groundwater. The estimated cancer risks and HIs for groundwater exposure exceeded EPA and MEDEP upperbound limits of acceptable risk. The compounds contributing the most to the risk for groundwater exposure include PCE, TCE and PCBs. Additional chemicals that exceeded EPA target risk levels and/or MCLs/ MEGs are 1,1-DCE, arsenic, manganese, 1,1,1-TCA, cis-1,2-DCE, 1,2,4,-trichlorobenzene, 1,1,1,2-tetrachloroethane, 1,4-

dichlorobenzene, benzene, tetrahydrofuran, bis(2-ethylhexyl)phthalate, and dieldren. Based on this assessment, both Source Area and Non-Source Area Groundwater are currently not suitable as domestic water supply source.

2. Ecological Risk Assessment

An Ecological Risk Assessment (ERA) was completed for the Site to evaluate the likelihood and magnitude of potential ecological effects associated with the discharge of Source Area Groundwater to the Site Pond and other nearby surface water bodies. The ERA also included an evaluation of the ecological effects from exposure to contaminated soils within the Source Area of the Site. However, this evaluation is not included in this ROD because soils that were found to present a potential ecological risk were located in an area that was excavated and disposed of off-site to allow access to the bedrock fractures during the 2001 pilot study. Consequently, soils that remain at the Site no longer present an ecological risk. Further information regarding the ERA for soils and the chemical oxidation pilot study can be found in Section 7 of the RI (Woodard & Curran, July 2001) and Section 1 of the FS (Woodard & Curran, July 2002).

<u>Identification of Chemicals of Potential Concern (COPCs)</u>

For the ecological screening, maximum concentrations of contaminants detected in surface water and sediments during the RI were compared to established numerical benchmarks to identify contaminants that exceeded these benchmarks and warranted further evaluation. A total of 11 contaminants for surface water and 14 contaminants for sediments were compared to established benchmarks for each media. Based on this comparison, 3 contaminants for surface water and 11 contaminants for sediments all exceeded a benchmark standard. Contaminants that exceeded benchmarks in both surface water and sediments include lead, mercury, and zinc. In addition, PCE, TCE, 1-1-DCA, *cis*-DCE, 2-hexanone, acetone, arsenic, and copper all exceeded applicable benchmarks for sediment. Contaminants with maximum concentrations that fell below relevant benchmark concentrations were assumed not to present a significant ecological risk and were not evaluated further.

The range of detected contaminant concentrations in surface waters and sediments, the frequency of detection, and benchmark standards for surface water and sediments are indicated in Table 10 and Table 11.

<u>Exposure Assessment</u>

As stated above, a total of 3 contaminants in surface water and 11 contaminants in sediments were retained for further evaluation in the ERA. Although a total of 12 discrete surface water bodies were sampled as part of the RI, the “Site Pond”, “Road Pond”, and “Farm Pond” were the primary focus of the ERA as these ponds represent the most likely surface water bodies affected by the migration and discharge of contaminants within the Source Area. In order to understand potential exposure pathways and receptors associated with these three surface water bodies, the habitat of each was evaluated to determine the type and extent of habitat that exist, record any evidence of wildlife species, and identify any sensitive species and critical habitats where the potential exposure to chemicals may be of concern. No aquatic species were observed in either the Site or Road Pond during the habitat assessment. In addition, no rare, threatened, or endangered species have been observed or recorded in the area.

The maximum concentration of dissolved lead, mercury, and zinc all exceeded their respective benchmarks for surface water, but were all below their benchmarks in the Site Pond, Road Pond, and Farm Pond, with the exception of lead, which was detected in the Site Pond at a concentration of 1.1 ppb; a value that slightly exceeded the Maine Surface Water Protection Criteria of 0.41 ppb. However, because lead was detected at similar concentrations when compared to background locations, concentrations of lead in the Site Pond were determined to be unrelated to the Site. With the understanding that the three ponds closest to the Source Area would be the most likely affected by the mobilization and discharge of site-related contaminants, and the fact that contaminant concentrations in these three ponds were below benchmark values, or in the case of lead, below background, surface water was not considered to be an exposure medium of concern.

Similar to surface water, sediments within the Site Pond, Road Pond, and Farm Pond were determined to be the most likely affected by discharge of Source Area contaminants. Benthic macroinvertebrates, which spend all or nearly all of their lifespan in or near the sediment, were identified as the primary receptors and assessment endpoints because they are immobile, abundant, in direct contact with, and ingesting sediment within these three ponds (Table 12).

Ecological Exposure Pathways of Concern Table 12						
Exposure Medium	Sensitive Environment Flag Y or N	Receptor	Endangered/ Threatened Species Flag Y or N	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Sediment	Y	Benthic organisms	N	Ingestion, respiration, and direct contact with chemicals in sediment	Benthic invertebrate community species diversity and abundance	Toxicity of soil to *Hyallela azteca* Species diversity index

Ecological Effects Assessment and Risk Characterization

Risks to benthic invertebrates were evaluated qualitatively by comparing the maximum observed sediment concentrations in the Site Pond, Road Pond, and Farm Pond to a chemical-specific, toxicity-reference value (TRV). The results of this comparison (maximum concentration/ TRV) are expressed as a Hazard Quotient (HQ) for each compound and are summarized in Table 13. Because the risks posed by some of the COPCs may be due to factors unrelated to the Site, the ERA included an evaluation of potential risk presented by contaminants common to all three ponds to help ensure that the risk characterization was focused on true potential risk drivers. Based on this evaluation, acetone was determined to be unrelated to the Site because it was not found in either Source Area soils or groundwater; is not a persistent contaminant in the environment and is a common sampling and laboratory contaminant. Similarly, inorganic metals were later determined to be unrelated to the Site because a comparison of HQs from these three ponds to background locations unaffected by the Site showed similar values. Collectively, these observations led to the conclusion that any ecological risk would be primarily related to VOC concentrations, which have a clear source at the Site, and which are not naturally present in aquatic systems.

The three ponds evaluated in the ERA had detectible VOC concentrations in sediments. However, only the Site Pond and Road Pond had concentrations that resulted in individual HQs greater than unity (>1), which suggests that exposure to sediments in these ponds can cause an ecological effect. However, the risks from exposure to sediments in the Site Pond were not considered to be an issue because the HQs associated with each contaminant were not significantly above unity despite the conservative assumptions used throughout the ERA. Similarly, while the concentrations of 1,1-DCA and cis-1,2-DCE suggest minor ecological effects from exposure to sediments in the Road Pond, these effects are expected to be limited because of the small size and the exposure potential of media.

Uncertainty

The major sources of uncertainty related to ERA are:

- Representativeness of sampling locations;
- Representativeness of sampling techniques;
- Selection of benchmark values;
- Selection of exposure point concentrations;
- Selection of benthic macroinvertebrates as key ecological receptors;
- Effects of complex mixtures of contaminants in sediments; and
- Risk estimates based on a single line of evidence

Conservative assumptions were made throughout the risk assessment to ensure that the ecological receptors are sufficiently protected. Therefore, when all of the assumptions are combined, it is much more likely that risks are overestimated rather than underestimated. A complete discussion of the evaluation of uncertainty for the Site is available in Section 7 of the RI.

3. Basis for Response Action

Because the baseline HHRA revealed that, if in the future, residents were to use the groundwater as a long-term water supply it would present an unacceptable human health risk (e.g., groundwater concentrations of COCs exceed EPA and MEDEP drinking water standards), actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. Additionally, while the risk to benthic organisms is expected to be minimal, the continued discharge of contaminated groundwater to the Site and Road Ponds could result in additional risks at some point in the future.

H. REMEDIATION OBJECTIVES

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, response action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment. The RAOs for the selected remedy for OU1 are:

- Prevent the use of groundwater containing contaminants that exceed federal or state maximum contaminant levels (MCLs), non-zero maximum contaminant level goals (MCLGs), maximum exposure guidelines (MEGs), or, an excess cancer risk of 1 x 10-6 or a hazard quotient of 1;

- Contain source area groundwater within the 2-acre fenced area of the Site and manage the migration of contaminants throughout the groundwater plume;

- Restore groundwater outside of the 2-acre fenced area of the Site (i.e., Non-Source Area Groundwater) to meet federal or state maximum contaminant levels (MCLs), non-zero maximum contaminant level goals (MCLGs), maximum exposure guidelines (MEGs), or, an excess cancer risk of 1 x 10-6 or a hazard quotient of 1; and

- Perform long-term monitoring of surface water, sediments, and groundwater to verify that the cleanup actions at the Site are protective of human health and the environment.

A complete description of the RAOs is presented in Section 3 of the FS.

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES

1. Statutory Requirements/ Response Objectives

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with all Federal and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

2. Technology and Alternative Development and Screening

CERCLA and the National Contingency Plan (NCP) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives was developed for Non-Source Area Groundwater. This range included an alternative that contains hazardous substances to the maximum extent feasible, preventing further degradation to Non-Source Area Groundwater. This range also included alternatives that involve little or no treatment but provide protection through engineering or institutional controls; and a no action alternative. As discussed in Section 5 of the FS, groundwater treatment technology options were identified, assessed, and screened based on implementability, effectiveness, and cost. Section 6 of the FS presented the remedial alternatives developed by combining the technologies identified in the previous screening process in the categories identified in Section 300.430(e)(3) of the NCP. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Each alternative was then evaluated in detail in Section 6 of the FS.

J. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of each remediation alternative evaluated for Non-Source Area Groundwater.

1. Source Control Alternatives Analyzed

Source control measures were previously addressed as part of the 1990-91 removal action and later as part of the 2001 pilot study. Because these activities resulted in the excavation and off-site disposal of contaminated soils within the Source Area, no source control measures were analyzed.

2. Management of Migration Alternatives Analyzed

Management of migration (MM) alternatives address contaminants that have migrated into and with the groundwater from the original source of contamination. Contaminants have migrated into groundwater underlying the George West property and surrounding area and are discharging to many of the surface water bodies surrounding the Source Area. The three MM alternatives proposed for the Site include:

GW-1, No Further Action: This alternative would not include any additional work. There would be no further cleanup actions for groundwater. EPA would leave the Site as it is, and no efforts would be made to control the migration of the contaminants in groundwater or to restore the groundwater.

Capital Costs: none
Present Worth of Long-Term Monitoring: 0

GW-2, Limited Action: This alternative would involve three major components:

- Implement land use restrictions to prevent use of the groundwater and to prevent additional pumping of groundwater that would impact the existing groundwater plume (see Figure 12);
- Monitor residential wells with a public water contingency;

- Perform long-term monitoring of surface water, groundwater, and sediments; and

- Five-year Reviews

No efforts would be made to control the migration of groundwater or reduce the existing contaminant concentrations in groundwater to the levels shown in Table 18. As a result, the high concentrations of contaminants within Source Area groundwater would continue to act as a source of groundwater contamination throughout the Site. The FS estimates a time period of 225-4,634 years before groundwater cleanup levels are achieved in the aquifer.

Long-term monitoring would be performed to detect any change in concentrations of contaminants in the groundwater and local water supply wells. Five year reviews would be performed to assess the Site conditions and determine if the cleanup approach is protective of public health and the environment. Institutional controls would target those properties where the groundwater plume has currently migrated or could be expected to migrate at some time in the future. While the institutional controls are being developed, public water would be provided to those properties where sampling of the existing private well indicates that people are being exposed to contaminants that pose an unacceptable risk.

Capital Costs: $1,559,000
Present Worth of Long Term Monitoring: $2,114,000
Total Costs: $3.6 million

GW-3, Hydraulic Containment: This alternative would actively control the migration of contaminated groundwater and allow for the possible restoration of the majority of the groundwater plume by containing Source Area Groundwater through a groundwater extraction and treatment system.

The major components of this alternative include:

- Installation of a long-term groundwater extraction and treatment system to prevent further migration of the existing groundwater plume by containing groundwater within the Source Area and potentially restore Non-Source Area Groundwater to the cleanup levels shown in Table 18;

- Implement land use restrictions to prevent use of the groundwater and to prevent additional pumping of groundwater that would impact the existing groundwater plume (see Figure 12);

- Monitor residential wells with a public water contingency; and

- Perform long-term monitoring of surface water, groundwater, and sediments.

Bedrock extraction wells would be used to extract and contain Source Area Groundwater. The objectives of the pumping system would be to contain contaminants within Source Area Groundwater thereby allowing the possible restoration of Non-Source Area Groundwater through natural processes. The land use restrictions, residential well monitoring with a public water contingency, and long-term monitoring would be the same as GW-2.

Five year reviews would be performed to assess the Site conditions and determine if the cleanup approach is protective of public health and the environment.

Capital Costs $3,447,000
Present Worth of maintenance, monitoring, periodic reviews: $4,688,000
Total Costs: $8.1 million

K. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a Site remedy. The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria. These criteria are summarized as follows:

Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP:

1. **Overall protection of human health and the environment addresses** whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with applicable or relevant and appropriate requirements (ARARs)** addresses whether or not a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked.

Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. **Longterm effectiveness and permanence** addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site.

5. **Short-term effectiveness addresses** the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. **Cost** includes estimated capital and Operation and Maintenance (O&M) costs, as well a present-worth costs.

Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after USEPA has received public comment on the RI/FS and Proposed Plan:

8. **State acceptance** addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

9. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. A comparative analysis of the threshold criteria and balancing criteria can be found in Table 8-1 of the FS, and included in this ROD as Table 15.

The sections below present the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis. Only those alternatives that satisfied the first two threshold criteria were balanced and modified using the remaining seven criteria.

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

Alternative GW-1, no further action, would be the least protective of the three alternatives; it would offer no protection to human health and the environment. Risks from exposure to contaminated groundwater would remain. Chemical concentrations in groundwater would remain in excess of MCLs and MEGs, and high levels of contamination within Source Area Groundwater would act as a continuing source of contamination to groundwater throughout the Site until it is degraded through natural attenuation. Under this alternative, there would be no restrictions on groundwater use.

Alternative GW-2, limited action, would provide greater overall protection than GW-1 because this alternative would employ institutional controls to restrict the use of groundwater and prevent further impacts to the existing groundwater plume. While these institutional controls are being developed, the environmental monitoring with the public water contingency would ensure that people who continue to use their private wells are not exposed to groundwater contaminants that pose an unacceptable risk. The implementation of institutional controls will require administrative coordination between governmental agencies and the affected property owners to ensure their effective implementation and enforcement.

Alternative GW-3 would provide greater overall protection of human health and the environment than either GW-1 or GW-2. GW-3 would eliminate further contamination to groundwater outside the 2-acre fenced area of the Site through hydraulic containment of Source Area Groundwater thereby allowing the clean-up of Non-Source Area Groundwater in a significantly shorter time than under current conditions. Similar to GW-1 and GW-2, Alternative GW-3 does not include active remediation of Non-Source Area Groundwater. However, unlike GW-1 and GW-2, the clean-up of Non-Source Area Groundwater can be accomplished through natural attenuation because further contaminant migration from Source Area Groundwater will be prevented. Institutional controls would provide comparable protectiveness to GW-2's through prohibiting the use of groundwater until the contaminants are reduced to acceptable levels.

Compliance with Applicable or Relevant and Appropriate Requirements

Section 121 (d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria and limitations which are collectively referred to as ARARs, unless such ARARs are waived under CERCLA 121 (d)(4).

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address hazardous substances, the remedial action to be implemented at the Site, the location of the Site or other circumstances present at the Site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law which, while not applicable to the hazardous materials found at the Site, the remedial action itself, the Site location or other circumstances at the Site, nevertheless address problems or situations sufficiently similar to those encountered at the Site that their use is well-suited to the Site.

Currently, several VOCs, arsenic, manganese, dieldren, and PCBs (Arochlor 1260) exceed chemical-specific ARARs (i.e., MCLs) in groundwater. In the short term, none of the groundwater response alternatives meet these chemical specific ARARS. In the long term, GW-3 is the only alternative that has the potential to meet chemical specific ARARs in a reasonable period of time. However, due to the uncertainty associated with the cleanup times for Non-Source Area Groundwater, EPA cannot make a finding that ARARs will be met in the interim. Consequently, EPA has waived these requirements for this ROD so that more precise cleanup times can be developed prior to EPA selecting a final remedy for this portion of the Site.

Neither location-specific nor action-specific ARARs apply to Alternative GW-1 because no remedial activities would be conducted. Similarly, location-specific ARARs do not apply to Alternative GW-2 because this alternative does not include remedial activities that could potentially impact wetlands. However, Alternative GW-2 would comply with all action-specific ARARs. Alternative GW-3 would comply with all location-specific and action-specific ARARs.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of the remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

Alternative GW-1 would provide the least long-term effectiveness because no actions would be taken to manage contaminant migration in groundwater, restore groundwater, or restrict the use of untreated contaminated groundwater. Alternative GW-2 would be more effective than GW-1 in the long term because institutional controls would be implemented to prevent use of contaminated groundwater. Effectiveness in the long term would depend upon effective enforcement. Alternative GW-3 is the most effective in the long term and also has the potential for the greatest permanence of the three alternatives as it would contain Source Area Groundwater thereby allowing for the potential restoration of Non-Source Area Groundwater. The long-term effectiveness of the institutional controls would be comparable to those of GW-2. Residual risks are comparable to GW-1 and GW-2 in the short-term. However, Alternative GW-3 could reduce residual risk in a shorter timeframe than GW-1 and GW-2.

Five-year reviews would be necessary to evaluate the protectiveness of any of these alternatives because hazardous substances would remain on-site in concentrations above health-based levels.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

No reduction is achieved in toxicity, mobility or volume through treatment under Alternative GW-1 or GW-2 because contaminated groundwater would not be treated. Alternative GW-3 provides some reduction in toxicity, mobility, and volume of contaminants through the extraction, treatment, and containment of contaminated groundwater.

Short-Term Effectiveness

Short-term effectiveness addresses a period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

Because no active remedial measures would be implemented under Alternatives GW-1 or GW-2, no additional short-term impacts would be anticipated from these two alternatives. Implementation of Alternative GW-3 would not result in significant short-term impacts to the local community or to on-site remedial workers.

Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other government entities are also considered.

Alternatives GW-1 and GW-2 are readily implementable because active remediation is not required. However, the implementation of land-use restrictions may present some challenges given the large number of parcels potentially impacted. Alternative GW-3, which requires construction of a hydraulic containment system, is also implementable. The aquifer investigations, construction of the extraction wells, injection wells, and treatment system rely on standardized materials and techniques. For all alternatives, additional response actions can be readily implemented if conditions warrant them.

Cost

The estimated present worth costs for the alternatives, not including the no action alternative, range from a low of \$3.6 million for alternative GW-2 to a high of \$8.1 million for Alternative GW-3.

State Support/Agency Acceptance

The State expressed its support for Alternative GW-3 at the public hearing held on August 6, 2002. A copy of the concurrence letter is included as Appendix A of this ROD.

Community Acceptance

During the public comment period, the community expressed its support for Alternative GW-3.

L. THE SELECTED REMEDY

1. Summary of the Rationale for the Selected Remedy

The selected remedy is the interim component of a comprehensive remedy for Non-Source Area Groundwater which utilizes groundwater extraction with on-site treatment to contain Source Area Groundwater, and monitored natural attenuation (MNA) for the Non-Source Area Groundwater. The selected remedy is the proposed preferred alternative that was identified in the Proposed Plan and that was presented in more detail in the FS.

The **major** components of the remaining selected remedy include:

- Installation of a groundwater extraction and treatment system to contain Source Area Groundwater within the 2-acre fenced area of the Site;

- Monitoring of surface water, sediments, and Non-Source Area Groundwater to measure the progress of natural attenuation toward meeting the cleanup goals;

- Residential well monitoring with a public water contingency;

- Institutional Controls to prevent use of both Source and Non-Source Area Groundwater and prevent further impacts to the existing groundwater plume; and

- Five-year Reviews.

A detailed description of the remedial components of the selected remedy is provided in subsequent sections of this ROD and in Table 15. Detailed costs are presented in Table 16.

2. Description of Remedial Components

Specific components of Alternative GW-3 include:

- **Installation of Groundwater Extraction and Reinjection Wells.** The extraction system would be developed to capture groundwater at the 10 ppm total VOC contour interval in both shallow and deep bedrock. The system would consist of a network of extraction wells that would be installed to a depth of about 80 feet below ground surface (bgs). Each of the extraction wells will be equipped with a vacuum enhanced recovery system (VERS) to prevent migration of NAPLs to deeper bedrock zones. Extracted groundwater will be treated then pumped from the treatment system to reinjection wells installed outside the perimeter of the extraction well network.

- **Installation of a Groundwater Treatment System.** A groundwater treatment system consisting of sand filters, an air stripper, and granular activated carbon (GAC) will be designed to remove contaminants from groundwater prior to it being transferred to the reinjection wells. As stated above, treated groundwater will be reinjected to the aquifer via a series of reinjection wells. The standards for reinjection of treated groundwater are the same as the groundwater cleanup standards for the Site. During operation of the groundwater extraction/treatment system, performance of the system would be monitored to ensure the continuing effectiveness of the treatment system. Influent and effluent monitoring will be performed to evaluate the effectiveness of the treatment system.

- **Monitored Natural Attenuation Outside the Treatment Zone.** Groundwater data collected to date shows that the Non-Source Area Groundwater plume has reached its maximum extent under current conditions. This observation, in conjunction with the hydraulic containment of Source Area Groundwater, creates favorable conditions for natural attenuation processes to reduce the concentrations of contaminants outside of the Source Area. Based on the results of Non-Source Area Groundwater, attenuation processes such as chemical degradation, dispersion, dilution, sorption, and volatilization appear to be effectively reducing the VOC concentrations at the edges of the existing groundwater plume. As such, the remedy will track the progress of natural attenuation by comparing data collected as part of the monitoring program (see below) with criteria that will be established to measure the effectiveness of MNA in meeting the cleanup goals established for the Non-Source Area Groundwater plume.

- **Environmental Monitoring with a Contingency for Providing an Alternative Drinking Water Supply.** Environmental Monitoring consisting of periodic sampling of Source and Non-Source Area groundwater monitoring wells, private residential wells within the Non-Source Area Groundwater plume boundary, surface water, and sediments (e.g., wetland areas, the on-site seep, Road pond, etc.) will be performed to evaluate the effectiveness of the selected remedy and to ensure that the remedy remains protective. Should monitoring indicate that an unacceptable risk is presented based upon sampling results obtained from private residential wells, alternate drinking water will be provided as part of this remedy. The decision as to how long to continue to monitor private residential wells shall be made in conjunction with the decisions made on institutional controls (see below).

- **Institutional Controls.** Institutional controls are administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use. They are typically used in conjunction with engineering controls, in this case groundwater collection and treatment.

Proprietary controls in the form of a covenant or similar legal instrument will be recorded in the chain of title for the George West property. This institutional control will prohibit the use of groundwater beneath this property until such time as a determination is made by EPA that cleanup standards have been met in the aquifer beneath the property and the groundwater is safe for use.

In addition, EPA has identified an area outside the boundaries of the George West property where groundwater contamination has, or has the potential to migrate. For many of these properties, EPA/MEDEP has provided drinking water to the residents as part of the removal action conducted in 1995. However, there are still a number of properties within this groundwater plume where people continue to use their existing private wells. EPA is currently requiring periodic monitoring of these wells to ensure that, in the short term, there is no unacceptable exposure to those currently using these wells. Similarly, there are a number of parcels located above or in the vicinity of the groundwater plume that are currently undeveloped but could, theoretically, be developed in the future. Should these lots be developed, there is the potential of an unacceptable risk to human health given that private wells installed on these lots could intercept and withdraw the contaminated groundwater underlying the property.

Because of the situation that exists at these properties (both developed and undeveloped) and the risk that could occur in the future, EPA will require that institutional controls be placed on all of the properties beyond the George West property where the groundwater plume has migrated beneath or could reasonably be expected to migrate beneath (i.e., the Institutional Control Zone (ICZ) (see figure 12). The ICZ currently includes 72 properties, however, EPA may modify the boundaries of the ICZ as more information is obtained. EPA will develop specific institutional control mechanisms (for example, a municipal ordinance, restrictive covenants, deed notices) in partnership with Town of Plymouth officials, landowners, and MEDEP. EPA will implement layered institutional controls that address enforcement, tracking, and continued public education.

Because imposition of institutional controls could affect a number of property owners in Plymouth, EPA will work with those affected by the ICZ to design institutional controls that make the most sense in terms of ensuring protectiveness while at the same time address property owners' concerns regarding restrictions on their properties. Once the ROD has been issued, EPA will work with the community and local government to develop a process to discuss the actual nature, type and number of institutional controls that may be required to be put in place.

Regardless of what decisions are made regarding institutional controls on those properties (both developed or undeveloped), institutional controls may be removed once the remedy has been completed, protectiveness has been determined and ARARs are deemed met by EPA.

As required by law, EPA will review the Site at least once every five years after the initiation of remedial action at the Site if any hazardous substances, pollutants or contaminants remain at the Site (until the groundwater cleanup goals are met) to assure that the remedial action continues to protect human health and the environment. As part of this review, EPA will collect and evaluate sediment samples from the Road Pond to confirm that the contaminant concentrations in sediments do not present an unacceptable risk.

The selected remedy may change somewhat as a result of the remedial design and construction processes. Changes to the remedy described in this Record of Decision will be documented in a technical memorandum in the Administrative Record for the Site, an Explanation of Significant Differences or a Record of Decision Amendment, as appropriate.

3. Summary of the Estimated Remedy Costs

The information in the cost estimate summary table for GW-3 (see Table 17) is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

4. Expected Outcomes of the Selected Remedy

The primary expected outcome of the selected remedy is that the migration of groundwater contaminants will be managed and Non-Source Area Groundwater will meet the cleanup levels specified in this ROD and be deemed protective at and beyond the point of compliance. Risk to human health from potential exposure to contaminated groundwater will be addressed in the short term through institutional controls that prevent the use of groundwater during the time period required for natural attenuation processes to cause the level of contamination to drop below the proposed cleanup levels. Approximately 35 to 1,434 years are estimated as the amount of time necessary for Non-Source Area Groundwater to achieve the cleanup goals established in this ROD. The selected remedy will also provide environmental and ecological benefits such as protection of sensitive benthic organisms living in contaminated sediments.

a. Cleanup Levels--Interim Groundwater Cleanup Levels

1. Interim cleanup levels have been established in Non-Source Area Groundwater for all chemicals of concern identified in the Baseline Risk Assessment found to pose an unacceptable risk to either public health or the environment. Interim cleanup levels have been set based on the ARARs (e.g., MCLs and more stringent State groundwater remediation standards) as available, or other suitable criteria described below. Periodic assessments of the protection afforded by remedial actions will be made as the remedy is being implemented and at the completion of the remedial action. At the time that Interim Ground Water Cleanup Levels and ARARs identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on all residual groundwater contamination to determine whether the remedial action is protective. This risk assessment of the residual ground water contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by all chemicals of concern (including but not limited to the current chemicals of concern) via ingestion, inhalation, and dermal contact with groundwater. If, after review of the risk assessment, the remedial action is not determined to be protective by EPA, the remedial action shall continue until either protective levels are achieved, and are not exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective or is modified. These protective residual levels shall constitute the final cleanup levels for this ROD and shall be considered performance standards for this remedial action.

Because the aquifer under the Site is a potential drinking water source, MCLs, non-zero MCLGs established under the Safe Drinking Water Act, and State of Maine Maximum Exposure Guidelines (MEGs) are ARARs.

Interim cleanup levels for known, probable, and possible carcinogenic chemicals of concern (Classes A, B, and C) have been established to protect against potential carcinogenic effects and to conform with ARARs. Since MCLGs for Class A and B compounds are set at zero and are thus not suitable for use as interim cleanup levels, MCLs have been selected as the interim cleanup levels for these chemicals of concern. MCLGs for the Class C compounds are greater than zero, and can readily be confirmed; thus MCLGs have been selected as the interim cleanup levels for Class C chemicals of concern.

Interim cleanup levels for Class D and E chemicals of concern (not classified, and no evidence of carcinogenicity) have been established to protect against potential non-carcinogenic effects and to conform with ARARs. Because the MCLGs for these Classes are greater than zero and can be readily confirmed, MCLGs and proposed MCLGs have been selected as the interim cleanup levels for these classes of chemicals of concern.

Where a promulgated State standard is more stringent than values established under the Safe Drinking Water Act, the State standard was used as the interim cleanup level. In the absence of an MCLG, an MCL, a proposed MCLG, proposed MCL, a more stringent State standard, or other suitable criteria to be considered (e.g., health advisory, state guideline), an interim cleanup level was derived for each chemical of concern having carcinogenic potential (Classes A, B, and C compounds) based on a 10^{-6} excess cancer risk level per compound considering the current or future ingestion, inhalation and dermal contact with groundwater. In the absence of the above standards and criteria, interim cleanup levels for all other chemicals of concern (Classes D and E) were established based on a level that represent an acceptable exposure level to which the human population including sensitive subgroups may be exposed without adverse affect during a lifetime or part of a lifetime, incorporating an adequate margin of safety (hazard quotient = 1) considering the current or future ingestion inhalation and dermal contact with groundwater.

The table below summarizes the Interim Cleanup Levels for carcinogenic and non-carcinogenic chemicals of concern identified in groundwater. While the maximum concentrations of other groundwater contaminants exceeded MCLs an/or MEGs (e.g., benzene, 1,1,1,2-tetrachloroethane, 1,4-dichlorobenzene, tetrahydrofuran, DEHP, chromium) the frequency of detection for these contaminants did not warrant the identification of specific cleanup levels. However, as described below, the selected remedy is expected to meet all ARARs (including MCLs and MEGs).

Interim Groundwater Cleanup Levels
Table 18

Carcinogenic Chemicals of Concern	Cancer Classification	Interim Cleanup Level (ug/l)	Basis	RME Risk
tetrachloroethene	B	3	MEG	5 E-06
trichloroethene	B	5	MCL	1 E-06
1,1-Dichloroethene	C	7	MCL	1 E-04
PCBs (Arochlor 1260)	B	0.05	MEG	2 E-05
dieldren	B	0.02	MEG	7 E-06
arsenic	A	10	MCL	2 E-04
Sum of Carcinogenic Risk				**3.3 E-4**

Non-Carcinogenic Chemicals of Concern	Target Endpoint	Interim Cleanup Level (ug/l)	Basis	RME Hazard Quotient
tetrachloroethene	liver	3	MEG	2 E-02
trichloroethene	liver	5	MCL	5 E-02
1,1-Dichloroethene	liver	7	MCL	5 E-02
cis-1,2 Dichloroethene	blood	70	MCL	4 E-01
1,1,1,-Trichloroethane	liver	200	MCL	6 E-01
1,2,4,-Trichlorobenzene	adrenal gland	70	MCL	7 E-01
PCBs (Arochlor 1260)	growth	0.05	MEG	1 E+00
dieldren	liver	0.02	MEG	2 E-02
arsenic	skin/ vascular system	10	MCL	9 E-01
manganese	central nervous system	200 (1)	MEG	2 E-01
Sum of Hazard Index			**0.7 E+00 (liver)**	

Key

MCL: Federal Safe Drinking Water Act Maximum Contaminant Level
MCLG: Non-zero Federal Safe Drinking Water Act Maximum Contaminant Level Goal
MEG: State of Maine Maximum Exposure Guidelines
HI: Hazard Index
RME: Reasonable Maximum Exposure
Note: (1) No MCL for Manganese exists; the 1992 Maine Maximum Exposure Guideline (MEG) is used.

All Interim Groundwater Cleanup Levels identified in the ROD, ARARs, and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy and the protective levels determined as a consequence of the risk assessment of residual contamination must be met at the completion of the remedial action at the points of compliance. Although EPA expects the selected remedy to significantly reduce contaminant concentrations throughout the Non-Source Area Groundwater plume, the estimated time to reduce concentrations to the levels shown in Table 18 is uncertain. Based on information that is currently available, the estimated time to meet the cleanup levels ranges from a low of 35 years to a high of 1,434 years depending on the assumptions used in the groundwater model developed for this Site. Because of the uncertainty associated with the cleanup times presented in this ROD, EPA expects to develop a more precise estimate of cleanup times by reducing the uncertainty of the assumptions used through additional site characterization and groundwater modeling during the second phase of the cleanup (i.e., Operable Unit II). Once this information has been developed and analyzed, a final decision will be made as to whether or not chemical-specific ARARs will be met.

Surface water will be monitored and the results compared to federal and state surface water quality criteria to ensure that the remedy does not adversely impact water quality. Sediments will also be monitored because of the presence of elevated levels of VOCs in sediment.

The expected decrease in VOC concentrations in groundwater will result in further reduction in VOC concentrations in surface water and sediments.

M. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs, with the exception of chemical-specific ARARS which are waived in the interim, and is cost effective. In addition, the selected remedy utilizes permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable, and satisfies the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element.

1. <u>The Selected Remedy is Protective of Human Health and the Environment</u>

The remedy at this Site will adequately protect human health and the environment by eliminating, reducing, or controlling exposures to human and environmental receptors. Hydraulic containment of Source Area Groundwater will prevent the further degradation of Non-Source Area Groundwater thereby allowing the cleanup of Non-Source Area Groundwater through natural attenuation processes (i.e., dilution, adsorption, volatization). In addition, hydraulic containment will reduce potential ecological risks by reducing discharges of Source Area Groundwater to nearby surface water bodies. Long-term environmental monitoring will track the progress of natural attenuation in meeting the clean-up goals for Non-Source Area Groundwater while institutional controls will prevent exposure to contaminated groundwater and prevent additional pumping of groundwater that would impact the existing groundwater plume. Finally, residential well monitoring with a public water contingency will help to ensure that people are not exposed to unsafe levels of contaminants prior to the implementation of institutional controls.

At the time that ARARs identified in the ROD and newly promulgated ARARs and modified ARARs that call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on the residual groundwater contamination to determine whether the remedy is protective. This risk assessment of the residual groundwater contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by relevant pathways of exposure to groundwater (e.g., ingestion, inhalation, and dermal contact). If, after review of the risk assessment, the remedy is not determined to be protective by EPA, the remedial action shall continue until protective levels are achieved and have not been exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the final cleanup levels for this ROD and shall be considered performance standards for any remedial action.

2. <u>The Selected Remedy Complies With ARARs</u>

The selected remedy will comply with all Federal and any more stringent State location and action specific ARARs that pertain to the Site. Because of the uncertainly associated with cleanup times, the ability of this remedy to meet chemical-specific ARARs within an acceptable period of time is uncertain. As a result, EPA is waiving these ARARs in the interim pursuant to section 121(d)(4)(A) of CERCLA so that more precise cleanup estimates can be developed prior to EPA making a final determination as to whether or not these ARARs can be met or should be waived. A discussion of the requirements that are applicable or relevant and appropriate to the Selected Remedy is discussed in detail in Section 2 of the FS Report. Furthermore, tables of Federal and State ARARS and TBCs for the Site are included in Appendix D of this ROD.

3. <u>The Selected Remedy is Cost-Effective</u>

In EPA's judgment, the selected remedy is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent state ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost-effectiveness.

From this evaluation, EPA determined that Alternative GW-3 was the most cost effective of the three remedial alternatives as it is the only alternative that has the potential to meet both threshold criteria and provided the best balance of the five balancing criteria. This alternative provides the greatest long-term effectiveness and permanence and is the only alternative that provides reduction in toxicity, mobility, and volume through treatment. In addition, GW-3 has the potential to significantly reduce future costs associated with the Site as it is the only alternative that reduces the timeframe for groundwater restoration, which would reduce the amount of time and associated costs necessary for long-term environmental monitoring.

4. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Once the Agency identified those alternatives that attain or, as appropriate, waive ARARs and that are protective of human health and the environment, EPA identified which alternative utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of: 1) long-term effectiveness and permanence; 2) reduction of toxicity, mobility or volume through treatment; 3) short-term effectiveness; 4) implementability; and 5) cost. The balancing test emphasized long-term effectiveness and permanence and the reduction of toxicity, mobility and volume through treatment; and considered the preference for treatment as a principal element, the bias against off-site land disposal of untreated waste, and community and state acceptance. The principal threats from soil at the Site was previously addressed as part of the 1990-91 removal action and the 2001 pilot study. The principal threat from Non-Source Area Groundwater is addressed in the interim through containment and MNA. Alternative GW-3, was determined to be the most effective in the long-term and also has the greatest permanence as it would contain Source Area Groundwater thereby allowing the potential restoration of Non-Source Area Groundwater. It also provides for a reduction in toxicity, mobility, and volume through treatment by containing the Source Area Groundwater.

5. The Selected Remedy Satisfies the Preference for Treatment Which Permanently and Significantly Reduces the Toxicity, Mobility or Volume of the Hazardous Substances as a Principal Element

Alternative GW-3 reduces the toxicity, mobility, and volume of groundwater contaminants through the extraction, treatment, and containment of Source Area Groundwater.

6. Five-Year Reviews of the Selected Remedy Are Required

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

N. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented the Proposed Plan to implement GW-3 for remediation of the Site on July 10, 2002. The preferred alternative includes containment of Source Area Groundwater, monitored natural attenuation of groundwater, institutional controls, and long-term monitoring and evaluation of groundwater, surface water, and sediments. EPA reviewed all written and verbal comments submitted during the public comment period from July 12, 2002 through August 12, 2002. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary.

O. STATE ROLE

The MEDEP has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the RI, HHRA, ERA, and FS to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental and facility siting laws and regulations. The State of Maine concurs with the selected remedy for the Site. A copy of the declaration of concurrence is attached as Appendix C.

RECORD OF DECISION RESPONSIVENESS SUMMARY

PREFACE:

In July 2002, the U.S. EPA presented a Proposed Plan for the long-term cleanup of the West Site/ Hows Corner Superfund Site in Plymouth, Maine. The Proposed Plan was based upon the remedial investigation and feasibility study (RI/FS) for the Site. All documents, which were relied upon in the selection of the cleanup action presented in the Proposed Plan, were placed in the Administrative Record, which is available for public review at the EPA Records Center at 1 Congress Street in Boston, Massachusetts and the Town Hall in Plymouth, Maine.

A 30-day comment period was held from July 12, 2002 to August 12, 2002. A public hearing was held on August 6, 2002. The comment period for the Proposed Plan ended on August 12, 2002.

The purpose of this Responsiveness Summary is to document EPA's responses to the questions and comments raised during the public comment period. EPA considered all of the comments summarized in this document before selecting a final remedial alternative to address contamination at the Site.

This Responsiveness Summary is organized into the following sections:

A. Summary of Comments Received During the Public Comment Period - This section summarizes, and provides EPA's response to, the oral and written comments received from the public during the comment period. Part A presents the comments received from citizens and local officials; Part B presents comments received from the Maine Department of Environmental Protection.

B. The Selected Remedy's Changes to the Proposed Remedy Made Based Upon Public Comments - This section summarizes any changes that were made to the preferred alternative presented in the Proposed Plan based upon EPA's consideration of the comments received during the public comment period.

A. SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD

This Responsiveness Summary addresses comments pertaining to the Proposed Plan and FS which were received by EPA during the comment period from July 12, 2002 to August 12, 2002. None of the comments received were in opposition to the proposed cleanup action.

<u>SUMMARY OF COMMENTS FROM CITIZENS AND LOCAL OFFICIALS</u>

1. *On behalf of the Hows Corner PRP Group Executive Committee, David Littell, Chairman of the Committee, asked that EPA extend the comment period beyond the August 12, 2002 deadline. David also expressed his personal preference that the Record of Decision (ROD) for off-site groundwater be an interim ROD rather than final ROD.*

Response: On August 12, 2002 EPA was notified that the Hows Corner PRP Group withdrew its request for an extension of the comment period. Consequently, the comment period closed on August 12, 2002. In regards to the request for an interim ROD, the ROD for Non-Source Area Groundwater is an interim decision because of the uncertainty regarding the ability to restore Non-Source Area Groundwater within a timeframe that would comply with all chemical-specific applicable or relevant and appropriate requirements (ARARs).

2. *An individual asked how long EPA would ensure that people are not exposed to (i.e., "drinking") contaminated water.*

   Response: The remedy described in this ROD includes provisions to prevent exposure to contaminated groundwater in both the short and long term. In the short term, EPA will rely on continued monitoring of residential wells that are potentially at risk. In the event that the sampling of these wells indicates that people are being exposed to contaminants that pose an unacceptable risk, EPA will provide public water to the affected property. In the long-term, institutional controls will prevent the use of groundwater on properties where there is the potential for people to be exposed to contaminants that pose an unacceptable risk. Both of these measures will be in effect until EPA determines that the groundwater contaminants are reduced to levels that are deemed to be protective.

3. *An individual asked if Alternative Hydraulic Containment (i.e.,GW-3) will be the remedy that is selected.*

   Response: Alternative GW-3, Hydraulic Containment, is the alternative that EPA presented to the public on July 10, 2002. The decision for remedy selection occurs after the comment period closes and is presented in the ROD.

4. *An individual asked if private wells that are no longer in use as a result of contamination can be used for geothermal power.*

   Response: Private wells that were abandoned as a result of contamination should not be used for any purpose including geothermal power unless it can be demonstrated that the well would not cause the further migration of groundwater contaminants or result in the discharge of groundwater above state and federal applicable or relevant and appropriate requirements (ARARs).

SUMMARY OF STATE OF MAINE COMMENTS

1. *MEDEP concurs with the EPA's proposed alternative (Alternative GW-3, Hydraulic Containment); however, they state that the institutional controls should be multilayered, such as municipal ordinances and restrictive covenants, and remain in place until such time as the clean up levels are met.*

   Response: EPA agrees with the comment. EPA will work with MEDEP, the Town of Plymouth, and the affected property owners to develop institutional controls that are multilayered, as appropriate, and in effect until the cleanup levels are met.

2. *MEDEP states that the prevention of the migration of the groundwater contaminant plume should be added as a Remedial Action Objective(RAO) for the Site.*

   Response: EPA agrees with the comment and will include this objective to the ROD.

3. *MEDEP states that additional investigation or study needs to be performed to refine the assumptions used in the groundwater model used to develop the cleanuptime frames.*

   Response: EPA agrees with the comment. EPA will collect the necessary information to refine the cleanup estimates as this task will be necessary prior to EPA making a statutory finding of compliance for the chemical-specific ARARs that have been identified for this Site.

B. THE SELECTED REMEDY'S CHANGES TO THE PROPOSED REMEDY MADE BASED UPON PUBLIC COMMENTS

EPA would like to thank all those who commented on the Proposed Plan for the West Site/ Hows Corner Superfund Site. Based on the content of those comments and EPA's response, no changes to the proposed remedy are warranted.